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CAUSATION IN TOXIC TORT LITIGATION: "WHICH WAY DO WE GO, JUDGE?"

Many can remember the Looney Toons character, Dumb Dog, who was often portrayed looking quite confused after the crafty Bugs Bunny pulled one of his famous disappearing acts. "Which way did he go? Which way did he go? Which way did he go, George?" Similarly, the toxic tort plaintiff, when confronted with the nearly impossible burden of establishing causation, may experience feelings of anxiety, frustration and desperation wondering how is he ever going to prove his case.¹ One can visualize plaintiff's counsel, like the cartoon character, standing in front of the judge after his last expert has been excluded on *Daubert* grounds asking, "Which way do we go, Judge?"²

The toxic tort is a new species of tort action and is an outgrowth of our industrialized society.³ Toxic tort cases, frequently

1. For a discussion of causation in toxic tort litigation, see *infra* notes 6, 11, 26-35 and accompanying text and note 78.

2. For a complete discussion of *Daubert v. Merrell Dow Pharm.*, 509 U.S. 579 (1993), see *infra* notes 56-65 and accompanying text.

3. See Christopher H. Buckley Jr. & Charley H. Haake, *Separating the Scientist's Wheat from the Charlatan's Chaff: Daubert's Role in Toxic Tort Litigation*, 28 ENVTL. L. REP. 10293 (June 1998) (discussing components of toxic tort cases); see also Robert F. Blomquist, *Witches' Brew: Some Synoptical Reflections on the Supreme Court's Dangerous Substance Discourse, 1790-1998*, 43 ST. LOUIS L.J. 297, 302 (discussing increasing awareness of harmful substances). Blomquist states:

Knowledge about harmful substances exploded during the twentieth century, particularly in the years following World War II. A sample of some significant developments include the following: the public studies of Louis Lewin, a German toxicologist, during the 1920s, on the chronic toxicity of narcotics and other alkaloids; the work of E.M. Geilling in the Pharmacology Department of the University of Chicago, during the 1920s, which explained the mechanism of toxicity for sulfanilamide and ethylene (chemicals which had earlier been used in medications for treating various bacterial diseases but were tragically responsible for several deaths from acute kidney failure); the discovery of DDT and phenoxy herbicides during the 1940s which, originally, were used as agricultural poisons, or pesticides; the discovery of organophosphate cholinesterase inhibitors by W. Lange and G. Schrader during the 1940s which sparked further important developments in neurophysiology and toxicology for years to come; the first publication during the late 1950s of the seminal journal *Toxicology and Applied Pharmacology*; the horrific discovery that the drug Thalidomide caused grotesque deformities of children born of women who took the drug while pregnant; the discovery of a "high-affinity cellular binding protein designated the 'Ah' receptor" and work on the genetics of this protein during the 1980s; and the growth, during the 1990s, of over 120 journals devoted to toxicology, risk assessment and risk management, and related fields.

arising in an environmental law context, involve personal injury and related harms resulting from exposure to toxic substances.⁴ The plaintiff's injury is often a syndrome or a terminal disease.⁵ "Because such injuries are not immediately apparent, because symptoms may not be unique to the disease, because the diseases remain latent for a long time, and because there is great opportunity for other sources of injury to arise, proving causation of a toxic tort is a challenging prospect."⁶

Commentators note that no "issue has been, or continues to be, more hotly debated in the courts than the appropriate means of dealing with scientific evidence" in toxic tort cases.⁷ The existence of these unique causation problems that confront plaintiffs in toxic

Id.

4. See Patricia E. Lin, *Opening the Gates to Scientific Evidence in Toxic Exposure Cases: Medical Monitoring and Daubert*, 17 REV. LITIG. 551, 552 (Summer 1998) (discussing nature of toxic tort cases).

5. See *id.* (describing common injuries in toxic torts).

6. *Id.* Long latency periods after exposure and the fact that the same illnesses occur naturally make it difficult to establish a prima facie tort claim. *Id.* Lin notes: Over time, memories fade, witnesses disappear, records are destroyed, and opportunities abound for other causative events to occur. Even afflictions with short latency periods can cause problems for parties seeking to establish causation. Scientific certainty that exposure to certain substances causes given diseases is often unavailable. Each person's physical idiosyncrasies, genetic make-up, and medical history make the determination of individual causation close to impossible.

Id. See generally M. Neil Browne, Terri J. Keeley & Wesley J. Heirs, *The Epistemological Role of Expert Witnesses and Toxic Torts*, 36 AM. BUS. L.J. 1 (Fall 1998) (stating that causation can not be established to certainty).

7. See generally Paul S. Miller & Bert W. Rein, *Wither Daubert? Reliable Resolution of Scientifically-Based Causality Issues in Toxic Tort Cases*, 50 RUTGERS L.J. 563 (Winter 1998). *Daubert* did not provide an abundance of guidance and the extent to which expert testimony must comply with admissibility standards in trials continues to present unsettled issues that are presently causing havoc in the expert evidence world. See *Daubert*, 509 U.S. at 593 (holding that Court has not set out definitive check list). Since June of 1998, the United States Supreme Court granted certiorari in two cases in order to review issues associated with the admissibility standards governing expert testimony under Rule 702 of the Federal Rules of Evidence and *Daubert*. See e.g., *Weisgram v. Marley Co., et al.*, 1999 WL 552788 (U.S. Sept. 28, 1999) (granting certiorari). The issue remanded for appeal in *Weisgram* is "[w]hether it is appropriate for an appeals court to order judgement as a matter of law after determining that a plaintiff's expert testimony should have been excluded at trial under Federal Rule of Evidence 702." *On the Docket: Weisgram, Chad et al. v. Marley Co., et al.*, NW. U. MEDILL SCH. J., (visited Oct. 19, 1999) <<http://www.medill.nwu.edu/cases.srch?database=Docket.../detail.srch&-search&doctet=99-016>>. See also *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 142 (Mar. 23, 1999) (determining principally that admissibility guidelines set forth in *Daubert*, may apply to evidence other than that based upon scientific knowledge). For further discussion of *Kumho Tire*, see *infra* notes 165-68, 179, 182 and accompanying text. For further discussion of admissibility guidelines, see *infra* notes 41-43 and 50-75 and accompanying text. For discussion of *Daubert*, see *infra* notes 56-65 and accompanying text.

torts makes it necessary for parties to offer expert testimony.⁸ While expert testimony is pervasive in all litigation, it is certainly offered in most every environmental case.⁹ One scholar noted that "an expert witness is like a flea collar. When your case is a dog, you need something that will chase the flees away, something that will keep your case from scratching and biting itself in front of the jury."¹⁰ Unfortunately for the toxic tort plaintiff, courts scrutinize expert causation testimony under numerous admissibility standards and a "ruling against admissibility frequently sounds the death knell for a plaintiff's cause of action."¹¹

This Comment examines the exceptional causation requirements of toxic tort litigation, the need for experts, the admissibility standards governing their testimony and the nature of the scientific evidence that plaintiffs' experts use to establish causation.¹² It begins by discussing how lower courts apply admissibility standards set forth by the United States Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals* and most recently affirmed in *Kumho Tire Co. v.*

Recognizing that a more codified, methodical analysis may be helpful to federal judges in determining whether expert testimony meets the admissibility requirements under Rule 702, the Advisory Committee on the Federal Rules of Evidence and the Standing Committee on Rules of Practice and Procedure have proposed amendments to several of the Rules. See, e.g., FED. R. EVID. 702 (Preliminary Draft 1998). The Advisory Committee proposes to amend Rule 702 to read:

If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or determine a fact at issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, *if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness had applied the principles and methods reliably to the facts of the case.*

Id. (emphasis added) (italicizing words that include proposed changes); see also Ruth E. Piller, *Coping with Kumho*, 24 LITIG. NEWS, Sept. 1999, at 7 (stating "[T]he proposed amendments to Rules 701-703 are intended to codify *Daubert* methodical analysis for trial courts to follow in gate-keeping situations"). Piller also stipulated that "[t]he Judicial Conference of the United States is expected to approved [sic] the amendments and forward them to the Supreme Court. They could become effective December 1, 2000." *Id.*

8. See *id.* (arguing necessity of expert evidence in establishing causation). For further discussion regarding need for expert testimony in toxic torts, see *infra* notes 36-40 and accompanying text.

9. Interview with John Hyson, Professor of Law, Villanova University School of Law, in Villanova, Pennsylvania. (Jan. 19, 2000).

10. JAMES W. McELHANEY, McELHANEY'S TRIAL NOTEBOOK 469 (3d ed. 1994).

11. See Miller & Rein, *supra* note 7, at 567 (citation omitted).

12. For discussion of causation requirements in toxic tort litigation, see *supra* note 6, and 11 and accompanying text, and see *infra* notes 26-35 and accompanying text and note 78. For discussion of the need for experts, see *infra* notes 36-40 and accompanying text. For discussion of the scientific evidence with which plaintiffs often seek to establish causation, see *infra* notes 87-129 and accompanying text.

Charmichael.¹³ Part Two argues that the key to admissibility may not be found in science, but in the law.¹⁴ This section attempts to provide theories favoring admissibility of evidence by emphasizing the impossibility of proving causation in toxic tort litigation.¹⁵ Finally, Part Three suggests that district court judges should make a conscious effort to understand the causation burdens confronting toxic tort plaintiffs and apply the *Daubert* standards with a "liberal thrust" favoring admissibility.¹⁶ The passage implies that exclusion of experts testifying as to "novel sciences" is not necessarily the appropriate response to an admissibility challenge.¹⁷ Judges should instead take advantage of their ability to employ their own experts in order to help them make determinations between "junk science" and "novel science," or they should leave credibility questions of "shaky" but admissible expert evidence to the jury.¹⁸

I. TOXIC TORT CAUSATION EVIDENCE GENERALLY

A. Establishing Liability in Toxic Tort Claims

Toxic torts have become an exceptional area of litigation for a variety of reasons.¹⁹ First, toxic tort cases are generally complex litigation cases brought by large groups of plaintiffs claiming that exposure to a particular substance caused injury.²⁰ A finding of liability or even potential liability may result in the discontinuance of a product line and bankruptcy, or a huge settlement or substantial

13. See *Kumho*, 526 U.S. at 137. For discussion of admissibility standards generally, see *infra* notes 41-43, 50-75 and accompanying text.

14. For discussion of legal notions favoring admissibility, see *infra* notes 139-86 and accompanying text.

15. For discussion of causation, see *infra* notes 26-35 and accompanying text and note 78.

16. For discussion of proposed application of more "liberal" admissibility standards favoring admissibility of expert evidence in toxic tort claims, see *infra* notes 139-86 and accompanying text.

17. For discussion of legal standards favoring a less restrictive approach with respect to admissibility determinations, see *infra* notes 139-86 and accompanying text.

18. For a discussion of court-appointed experts, see *infra* notes 176-85 and accompanying text. For discussion of the jury's role in weighing credibility of experts, see *infra* notes 160-62 and accompanying text.

19. See Browne, *supra* note 6, at 2 (noting that toxic torts constitute a "noteworthy" area of litigation).

20. See *id.* at 2-3 (discussing that toxic tort litigation is noteworthy because 1) cases involve large numbers of plaintiffs; 2) damage theories are new; and 3) cases involve proof of causation). "Simply put, the toxic tort plaintiff attempts to establish that exposure to a particular substance caused an injury." *Id.*

judgement payable to hundreds of thousands of plaintiffs.²¹ Many common product lines have been the subjects of toxic tort actions such as: 1) asbestos; 2) lead; 3) Bendectin; 4) DES and Thalidomide; 5) tobacco; 6) Agent Orange; 7) formaldehyde; 8) pesticides; 9) herbicides and 10) benzene.²² Typically, allegedly injured parties bring action under theories of negligence, trespass, liability for abnormally dangerous activities, strict products liability or nuisance.²³ While these legal causes of action are relatively traditional, the injuries they seek to redress have been relatively new to the law since World War II.²⁴ These novel injuries, which set toxic tort cases apart from traditional tort actions and constitute a second reason for which toxic torts are exceptional, include: "1) fear of future disease; 2) increased risk of disease; and 3) medical monitoring."²⁵ Finally, while it is generally necessary for plaintiffs seeking to establish liability in traditional tort actions to prove causation, actions brought by toxic tort plaintiffs are distinguishable because plaintiffs are not able to establish causation to certainty.²⁶ It may, in fact, be impossible for a plaintiff to show that a particular substance caused

21. See *id.* at 2 (discussing potential effects of toxic tort actions on defendants).

22. See Browne, Keeley & Heirs, *supra* note 6 at n.14 (listing product lines that have been subjected to toxic tort litigation). For discussion of varying approaches with which courts analyze causation evidence among product lines, see *infra* note 78 and accompanying text.

23. See Browne, Keeley & Heirs, *supra* note 6, at n.14 (describing causes of action under which toxic tort claims arise).

A toxic tort meets one or more of the following characteristics: 1. The plaintiff's alleged injury is not a traumatic response; instead, the injury results from genetic or biochemical disruption. 2. The plaintiff's exposure is usually, but not necessarily, chronic and repeated. 3. The plaintiff's physical injuries manifest themselves after a long latency period.

Id. at n.4 (citing Steve Gold, Note, *Causation in Toxic Torts: Burdens of Proof, Standards of Persuasion, and Statistical Evidence*, 96 YALE L.J. 376 (1986)).

24. See Browne, Keeley & Heirs, *supra* note 6, at n.5 (addressing new types of injuries alleged in toxic tort litigation).

25. See *id.* at 3 and n.3 (discussing new damage theories addressed in toxic tort litigation). "[Toxic tort] cases span a variety of claims for damages, equity, and insurance coverage." *Id.* at n.3.

A fear of future disease claim is a type of emotional distress claim. An increased risk of disease claim seeks recovery for the "potential future injury of contracting the feared disease." Finally, a medical monitoring claim seeks recovery for diagnostic testing and medical examinations after exposure to a toxic substance in order to permit the earliest detection and treatment if the feared disease should occur.

Id. at n.15 (citations omitted) (quoting Ernest G. Getto et al., *Toxic Tort Symposium: Evolving Standards For Fear of Future Disease Claims in the Post-Potter Era*, 10 TUL. ENVTL L.J. 307, 310-12 (1997)); see also Lin, *supra* note 4, at 554 (discussing medical monitoring as potential remedy). For discussion of medical monitoring claims and causation issues arising therefrom, see *infra* note 31.

26. See *id.* at 3 (stating that "causation cannot be proven to certainty").

injury, and it may be equally as difficult for a defendant to establish that the particular substance in question did not cause the plaintiffs' injury.²⁷ Accordingly, plaintiffs are not required to show that a particular injury occurred at a particular time and place.²⁸ Plaintiffs will, therefore, rely on "probabilistic" evidence.²⁹

By using such "probabilistic" evidence to establish liability, plaintiffs must show that they have been exposed to a harmful substance and that such exposure resulted in injury.³⁰ Courts require that plaintiffs establish two types of causation: general and specific.³¹ Courts generally agree that "[g]eneral causation addresses whether products of the same nature as defendant's products are capable of causing the type of injuries alleged . . . ; specific causation addresses whether defendant's product more likely than not caused injuries in the particular case."³² Specific causation, there-

27. See Buckley and Haake, *supra* note 3 (discussing significant role of expert testimony in toxic tort litigation).

28. See *id.* (discussing causation requirements for toxic torts).

29. See *id.* (discussing that plaintiffs must use "probabilistic" evidence to establish causation).

30. See *id.* (discussing elements necessary to establish liability in toxic tort cases).

31. See *Heller v. Shaw Industries (Heller I)*, No. Civ. A. 95-7657, 1997 WL 535163, at *4 (E.D. Pa. 1997) (Mem.) (discussing general and specific causation). Buckley notes:

[The causation method] requires first that the expert determine the dosage of the toxin at issue to which the plaintiff was exposed Second, the expert must establish "general causation" by demonstrating that, according to scientific literature, levels of the toxin comparable to those received by the plaintiff can cause the specific types of injuries he alleges Third, the expert must establish specific causation, by demonstrating that, more likely than not, the toxin caused plaintiff's injuries in a particular case.

Buckley & Haake, *supra* note 3 (quoting *Mancuso v. Consolidated Edison Co. of New York*, 967 F. Supp. 1437, 1445-46 (S.D.N.Y. 1997)); see also Ellen Relkin, *The Sword or the Shield: Use of Commercial Regulations, Exposure Standards and Toxicological Data in Toxic Tort Litigation*, 6 DICK. J. ENV. POL. 1, 2-3 (discussing general and specific causation and exposure levels of toxic substances).

In an action for medical monitoring damages, however, plaintiffs do not have to prove specific causation. See Lin *supra* note 4, at 582. Instead, plaintiffs must prove medical necessity which requires a showing that the individual plaintiff can benefit from a medical monitoring program. *Id.* The same types of evidence, however are needed in order to prove specific causation and medical monitoring. *Id.* For a further discussion of causation requirements among product lines, see *infra* note 78 and accompanying text.

32. See, e.g., *Heller I*, 1997 WL 535163, at *6 (Mem.) (citing *Rutigliano v. Valley Business Forms*, 929 F. Supp. 779, 783 (D.N.J. 1996), *aff'd*, 118 F.3d 1577, 1997 U.S. App. LEXIS (3d Cir. N.J. 1997)); *Mascarenas v. Miles Inc.*, 986 F. Supp. 582, 587-88 (W.D. Mo. 1997) (discussing causation requirements); see generally *Wright v. Williamette Industries, Inc.*, 91 F.3d 1105, 1108 (8th Cir. 1996) (requiring proof of exposure to toxic substance in levels known to cause injury); *In re Paoli Railroad Yard Litig.*, 916 F.2d 829, 833 (3d Cir. 1990) (requiring exposure as element in

fore, requires plaintiffs to prove, by a preponderance of the evidence, 1) that defendants released toxins into the environment; 2) that plaintiffs were exposed to the toxins; 3) that plaintiffs have suffered an injury and 4) that the toxins released by defendants caused the injury.³³ Accordingly, plaintiffs must prove that they were exposed to toxins produced by defendant at levels that exceed normal background levels and that the duration and dosage of the exposure were at levels significantly high to cause injury to humans.³⁴ One court noted:

First an evaluation is made of the chemicals to which the individual might have been exposed, and of the concentrations of these chemicals The second step involves an evaluation, based upon the published scientific literature, of the exposures necessary to produce the adverse effects associated with the chemicals to which the individual may be exposed.³⁵

B. The Need for Expert Witnesses

In toxic tort cases, it is necessary for plaintiffs to provide expert testimony in order to assist the trier of fact in drawing conclusions.³⁶ An expert witness "is one, who, by training, education, or

toxic tort); *Maddy v. Vulcan Materials, Co.*, 737 F. Supp. 1528, 1533 (Kan. 1990) (discussing that plaintiff must demonstrate that she was, in fact, exposed to harmful substance).

33. See *Heller I*, 1997 WL 535163, at *6 (MEM); see also Buckley & Haake, *supra* note 3 (outlining general and specific causation). "Courts have correctly recognized, however, that the issue of specific causation cannot be examined in a vacuum. Courts must consider the doses to which the plaintiff was allegedly exposed. After all, [sic] in sufficient quantities, just about any substance, including water, can be toxic." *Id.*

34. See *Heller I*, 1997 WL 535163, *6 (Mem.) (citing *Mateer v. U.S. Aluminum*, 1989 WL 60442, at *6 (E.D. Pa. June 6, 1989)).

35. *Cavallo v. Star Enter.*, 893 F.Supp. 756, 764 (E.D. Va. 1995), *aff'd in part, rev'd in part on other grounds*, 100 F.3d 1150 (4th Cir. 1996), *cert. denied*, 1998 WL 6290 (U.S. Jan. 12, 1998).

36. See Joseph Sanders, *Scientifically Complex Cases, Trial by Jury, and the Erosion of the Adversarial Process*, 48 DEPAUL L. REV. 355. Sanders stipulates:

It is commonplace that expert testimony plays an important role in civil litigation, especially in tort litigation. Recently, its ubiquity has been documented in several studies. For example, a study of 529 civil jury trials in California between 1985 and 1986 revealed that experts testified in 86% of the cases and that an average of 3.8 experts testified in each case. Experts appeared in 100% of the products liability cases The widespread use of experts is beyond conjecture.

Id. at 357-58 (footnotes omitted); see also FED. R. EVID. 702 (providing that expert may testify in form of opinion or otherwise if scientific, technical or other specialized knowledge will assist trier of fact).

experience has acquired a special level of skill or knowledge in some art, science, profession, or calling.”³⁷

Commentators note that litigants may use experts to establish exposure to a particular substance and to determine the nature of plaintiffs’ injuries.³⁸ But, causation experts, who seek to link exposure and injury in order to establish both general and specific causation, are most frequently used in toxic tort litigation.³⁹ Because of the nature of the causation requirements in toxic torts, “the success or failure of the case may well hinge on the . . . expert testimony.”⁴⁰

Courts have the ability, however, to exclude expert opinion evidence if it fails to comply with certain standards.⁴¹ Admissibility standards are in place to assure that “experts adhere to the same standards of intellectual rigor that are demanded in their professional work.”⁴² Accordingly, testimony in toxic tort litigation based upon “junk” science that is prepared solely in anticipation of litigation will be inadmissible as evidence.⁴³ If a court determines that

37. See Hon. Mark I. Bernstein, *Expert Testimony in Pennsylvania*, 68 TEMP. L. REV. n.2 (1995) (citing PENNSYLVANIA SUGGESTED STANDARD CIVIL JURY INSTRUCTIONS, Instruction 5.30 Pa. Sup. Ct. Comm. for Proposed Standard Jury Instructions 1981; PENNSYLVANIA SUGGESTED STANDARD CRIMINAL JURY INSTRUCTIONS, Pa. Sup. Ct. Comm. for Proposed Standard Jury Instructions 1991).

38. See Browne, Keeley & Heirs, *supra* note 6, at n.19 (citing L. Grant Foster, *A Case Study in Toxic Tort Causation: Scientific and Legal Standards Work Against Recovery for Victims*, 19 ENVTL. L. 141, 149 (1988)).

39. See *id.* (analyzing why causation experts are the most frequently used).

40. Cynthia H. Cwik, *Guarding the Gate: Expert Evidence Admissibility*, 25 No. 4 A.B.A.J. SEC. LITIG. 6, (Summer 1999). The commentator stated:

In toxic tort and products liability cases, a motion in limine to exclude expert evidence under *Daubert* is often coupled with a motion for summary judgement. More specifically, counsel will often argue that, if the motion to exclude expert evidence is granted, the other side will not be able to establish a key element of the case—causation, for example—and the case therefore must be dismissed.

Id. at 10.

41. See, e.g., *Daubert v. Merrell Dow Pharm.*, 509 U.S. 579 (1993) (holding that expert testimony must be reliable and relevant).

42. See Daniel J. Capra, *The Daubert Puzzle*, 32 GA. L. REV. 699, 735 (Spring 1998) (quoting *Rosen v. Ciba-Geigy Corp.*, 78 F.3d 316, 318 (7th Cir. 1996)).

43. See Bert Black, Francisco J. Ayala & Carol Saffran-Brinks, *Science and the Law in the Wake of Daubert: A New Search for Scientific Knowledge*, 72 TEX. L. REV. 715, 719-21, 748-49 (1994) (theorizing that judges should screen out “junk science”); see generally Peter Huber, *GALILEO’S REVENGE: Junk Science in the Courtroom* (1991) (discussing whimsical nature with which experts draw conclusions and comparing differences between scientific standards for accepting hypothesis and legal standards for determining reliability of such acceptance); Kenneth J. Chesebro, *Peter Huber’s Junk Scholarship*, 42 AM. U. L. REV. 1637 (1993) (discussing Huber’s account of junk science); see also Browne, Keeley & Heirs, *supra* note 6, at 4 (noting that legal scholars have “lamented the use of expert testimony in toxic tort cases because ‘junk science’ is infiltrating the courtroom”).

proffered expert evidence is inadmissible, plaintiffs may fail to establish one of the necessary elements of a toxic tort claim — specifically, causation.⁴⁴ The claim, therefore, will not survive.⁴⁵ Since exclusion of such evidence is usually outcome determinative, the real liability battle is often waged before the case even materializes in a courtroom.⁴⁶ Accordingly, before the trial commences, counsel will often file motions to exclude or motions in limine arguing that the opposing party's expert evidence should be excluded on the grounds that it does not satisfy admissibility standards.⁴⁷ If the trial court agrees with a defendant's motion to exclude expert evidence, a plaintiff may have a significantly more difficult, if not impossible, time proving causation.⁴⁸ On the other hand, if the trial judge disagrees with defendant's assertions, the admission of expert testimony may provide an incentive for defendant to settle.⁴⁹

C. Admissibility Standards for Expert Evidence

The admissibility standards enumerated by the Federal Rules of Evidence with respect to scientific evidence and the cases that interpret such rules are applicable in toxic tort litigation because expert witnesses "use the language of science . . . to present their arguments."⁵⁰ Rule 702 of the Federal Rules of Evidence provides: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact at issue, a witness qualified as an expert . . . may testify thereto in the form of an opinion or otherwise."⁵¹ Accordingly, if expert testi-

44. See Chesebro, *supra* note 43, at 1638 (showing fatal effect inadmissible evidence may have on plaintiff's case).

45. See *id.* (stating that summary judgement may be appropriate where plaintiff is unable to establish causation with expert evidence).

46. See Buckley & Haake, *supra* note 3 (discussing pre-trial issues of admission with respect to expert testimony).

47. See Judge Harvey Brown, *Procedural Issues Under Daubert*, 36 Hous. L. Rev. 1133, 1139 (Winter, 1999) (discussing pre-trial motions filed in order to request exclusion of testimony). Parties usually raise expert evidence admissibility challenges at what has become known as a *Daubert* hearing. See *id.* at 1139, n.39. Courts have not explained, however, what this hearing "is, how it is invoked, when it is to be conducted relative to the commencement of trial, and whether it is required." *Maritime Overseas Corp. v. Ellis*, 971 S.W.2d 402, 422-23 (Tex. 1998) (Hecht, J., dissenting).

48. See Buckley & Haake, *supra* note 3 (illustrating consequences of exclusion of expert evidence).

49. See *id.* (discussing possible consequences of admission of expert testimony).

50. See Browne, Keeley & Heirs, *supra* note 6, at 3-4 (discussing experts' use of scientific knowledge to establish causation).

51. FED. R. EVID. 702. Most states have adopted rules of evidence very similar to the federal rules and have accordingly employed the *Daubert* standard with re-

mony is not based upon “scientific, technical or other specialized knowledge,” or if such evidence does not “assist the trier of fact,” the opinion of the expert is inadmissible.⁵²

1. *Reliability and Relevance — Standards and Requirements.*

Although the Federal Rules of Evidence provide generally that “all relevant evidence is admissible,”⁵³ courts have the power to exclude any and all expert evidence that is not both relevant and reliable.⁵⁴ Rule 702 of the Federal Rules of Evidence supersedes prior common law notions of relevancy and reliability in all federal jurisdictions and most states.⁵⁵ In *Daubert v. Merrell Dow Pharm.*, the

spect to admissibility of expert witnesses. See Lin, *supra* note 4, at n.15 (listing states which have accepted and rejected *Daubert*).

52. FED. R. EVID. 702. For further discussion of admissibility requirements, see *infra* notes 53-75 and accompanying text.

53. See FED. R. EVID. 402. For further discussion of courts’ power to exclude expert evidence, see *infra* notes 61, 76-77, 79-82, 132, 134-38, 166, 185 and accompanying text and note 63.

54. See *Daubert*, 509 U.S. 579 (noting that under the Rules, the trial judge must ensure that scientific testimony or evidence admitted is both relevant and reliable). “Relevant evidence” is defined as any evidence which “has a tendency to make the existence of any fact that is of consequence to the determination of the action more or less probable than it would be without the evidence.” *Id.* at 587 (citing FED. R. EVID. 401). Reliable evidence is that which pertains to scientist’s knowledge and is based upon good grounds. *Id.* at 590.

55. See *id.* at 587 (holding that “general acceptance test” is no longer standard by which evidence would be evaluated in federal trials). In 1923, the United States Court of Appeals for the District of Columbia decided *Frye v. United States*, 293 F. 1013 (1923), which effectively established a common law test for the admissibility of evidence — the “general acceptance test.” *Daubert*, 509 U.S. at 585-87. In *Frye*, the relevant issue turned on the admissibility of evidence derived from a systolic blood pressure deception test which was a crude predecessor to the polygraph. See *Frye*, 293 F. at 1014. The *Daubert* Court noted:

In what has become a famous (perhaps infamous) passage, the then Court of Appeals for the District of Columbia described the device and its operation and declared: “Just when a scientific principle or discovery crosses the line between the experimental and the demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and the courts will go a long way in admitting expert testimony deduced from a well recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.”

Daubert, 509 U.S. at 585-86 (quoting *Frye*, 293 F. at 1014).

In *Daubert*, which was decided seventy years after *Frye*, petitioners attacked the continuing authority of the “general acceptance test” and argued that the admissibility standards of the Federal Rules of Evidence supersede the *Frye* test. See *id.* at 587. The Supreme Court agreed. See *id.* at 589 (stating that general acceptance test, “absent from and incompatible with, the Federal Rules of Evidence, should not be applied in federal trials”). Some states, however, continue to use the *Frye* standard and have not adopted *Daubert*. See Lin, *supra* note 4, at n.15 (listing states that reject *Daubert* and which have retained *Frye*).

United States Supreme Court interpreted Rule 702 and concluded that “pertinent evidence based upon scientific principles” will satisfy both the relevancy and reliability requirement.⁵⁶

Focusing primarily upon the words, “scientific knowledge,” in order to interpret Rule 702’s notion of reliability, the Court established that in order to qualify as scientific knowledge, the expert witness’s inference or assertion upon which he or she based his or her opinion must be derived from scientific method and supported by “appropriate validation—i.e. ‘good grounds,’ based on what is known.”⁵⁷ This requirement established a standard of reliability, and each step of an expert’s analysis must pass this standard.⁵⁸

The relevancy standard of the Federal Rules of Evidence requires that the proffered evidence “assist the trier of fact” in the sense that the conclusions generated and proffered as evidence must “fit” with the facts of the case.⁵⁹ In other words, the *Daubert* Court interpreted Rule 702 to require that the expert testimony “must have a valid scientific connection to the pertinent inquiry as a precondition to admissibility.”⁶⁰

56. See *Daubert*, 509 U.S. at 597 (discussing relevancy and reliability requirements); see also *Kumho Tire Co. Ltd. v. Carmichael*, 526 U.S. 137, 142 (1999) (holding that *Daubert* interpretation of Rule 702 and admissibility factors enumerated by Supreme Court in *Daubert* are also applicable to non-scientific expert evidence).

57. *Daubert*, 509 U.S. at 590 (quoting “[T]he subject of an expert’s testimony must be scientific . . . knowledge.”) (footnote omitted). The *Daubert* Court determined that “scientific knowledge” means “any body of known facts or . . . any body of ideas inferred from facts or accepted as truths on good grounds” in the methods and procedures of science. *Id.* (citing WEBSTER’S THIRD NEW INTERNATIONAL DICTIONARY 1252 (1986)).

58. See *id.* (stating “[i]n short, the requirement that an expert’s testimony pertain to ‘scientific knowledge’ establishes a standard of evidentiary reliability”).

59. *Id.* at 591 (holding “[R]ule 702 further requires that the evidence or testimony ‘assist the trier of fact to understand the evidence or determine a fact in issue.’ This condition goes primarily to relevance.”); see also FED. R. EVID. 402 (requiring that evidence be relevant).

60. *Id.* at 592 (stating that “Rule 702’s ‘helpfulness’ standard requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility”). “The consideration has aptly been described by Judge Becker as one of ‘fit.’” *Id.* at 591 (citing *United States v. Downing*, 753 F.2d 1224, 1242 (3d Cir. 1985)). “‘Fit’ is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other unrelated purposes.” *Id.* See generally *In re Paoli R.R. Yard PCB Litigation*, 35 F.3d 717, 748 (3d Cir. 1994) (discussing relevance as it applies to admissibility of testimony); see also *Confronting the New Challenges of Scientific Evidence*, 108 HARV. L. REV. 1532, 1556-57 (1996) (discussing scientific validity and its potential role in determining relevance).

2. Additional Guidelines for Determining Admissibility

In *Daubert*, the Court provided some “general observations” in order to “help” federal judges determine whether a particular scientific theory or technique is “scientific knowledge that will assist the trier of fact.”⁶¹ These factors provide a basis upon which attorneys disputing admissibility can direct the court’s attention.⁶² The *Daubert* factors, which focus primarily on reliability, are: 1) whether the theory or technique can be or has been tested; 2) whether the theory or technique has been subjected to peer review and publication; 3) whether the theory or technique has been “generally accepted” within the scientific community; 4) whether a potential rate of error exists in cases involving particular scientific techniques; and 5) whether standards which control the technique’s operation exist and were maintained.⁶³ Upon remand to the Ninth Circuit, that court added an additional factor to the five offered by the Supreme Court.⁶⁴ The Ninth Circuit held that courts should also consider “whether the experts are proposing to testify about matters growing naturally and directly out of research they have conducted independent of litigation, or whether they have developed their opinions expressly for the purposes of testifying.”⁶⁵

The *Daubert* opinion was open-ended and vague.⁶⁶ Several Post-*Daubert* opinions sought to “put some meat on *Daubert*

61. See *Daubert*, 509 U.S. at 593. These “general observations” are commonly referred to as the *Daubert* factors. See, e.g., *Kumho Tire*, 526 U.S. 137 (referring to the additional standards set forth in *Daubert* as “*Daubert* factors”); *Heller v. Shaw Industries Inc.*, 167 F.3d 146, 144 (3d Cir. 1999) (citing the “*Daubert* factors”); *Paoli*, 35 F.3d at 742 n.8 (adding to *Daubert* factors by borrowing some from the Third Circuit’s decision in *Downing*. Some courts also refer to these factors as the “*Downing* factors,” as the *Daubert* Court “borrowed [them] from the many [that] Chief Justice Becker listed in [*Downing*].” *Kent v. Howell Electric Moors, et al.*, No. 96-7221, 1999 U.S. Dist. LEXIS 10940 at *11 (E.D. Pa. July 20, 1999).

62. See Nina Gussak, Partner at Pepper Hamilton, LLP, Philadelphia, Pa. and Chair of the Health Effects Litigation Practice, Address, “Keeping Junk Science Out of the Courtroom” (Feb. 10, 2000).

63. See *Daubert*, 509 U.S. at 593-94 (listing some “general observations” intended to assist federal judges in their “gate[-]keeping” capacities). See, e.g., *Moore v. Ashland Chemical Inc.*, 151 F.3d 269, 273 (5th Cir. 1998) (listing same *Daubert* factors). Sometimes courts and commentators mention that there are four *Daubert* factors. See, e.g., *Heller v. Shaw Industries*, 167 F.3d 152, 156 (3d Cir. 1998) (citing four factors by combining two and listing as one).

64. See *Daubert v. Merrell Dow Pharm., Inc. (Daubert II)*, 43 F.3d 1311, 1317 (9th Cir. 1995) (discussing admissibility standards of expert evidence).

65. See *id.* at 1317 (adding additional factor to those enumerated by Supreme Court).

66. See FED. R. EVID. 702 advisory committee’s notes (noting that *Daubert* opinion was open ended and vague).

bones.”⁶⁷ For example, approximately one year after *Daubert*, the Third Circuit decided *In re Paoli*.⁶⁸ In *Paoli*, the Third Circuit set forth additional factors that “a district court should take into account when evaluating whether a particular scientific methodology is reliable.”⁶⁹ These factors are: 1) the degree to which the testifying expert is qualified;⁷⁰ 2) the “nonjudicial uses to which the scientific technique is put,”⁷¹ and 3) the relationship of a particular technique to the established modes of scientific analysis.⁷² These additional guidelines effectively gave district courts that chose to follow *Paoli* a more exhaustive list of criteria under which to exclude testimony.⁷³ Many courts throughout the country have incorporated the *Paoli* factors as admission criteria in addition to the *Daubert* factors, while other courts and authorities presented variations of these admissibility standards by imposing their own sets of factors.⁷⁴ The Supreme Court, however, has expressed

67. See *id.* (discussing post-*Daubert* opinions). For further discussion of post-*Daubert* holdings, see *infra* notes 68-75 and accompanying text.

68. See *In re Paoli Railroad Yard Litig.*, 916 F.2d 829, 832 (3d Cir. 1990) (deciding case on August 31, 1994, and amending October 17, 1994).

69. *Paoli*, 35 F.3d at 742 n.8 (listing eight total *Daubert*/*Paoli* factors).

70. See *id.* at 742; see also *United States v. Downing*, 753 F.2d 1224, 1238 (3d Cir. 1985).

71. *Downing*, 753 F.2d at 1238-39.

72. See *Paoli*, 35 F.3d at 742 (setting forth admissibility criteria in addition to those enumerated in *Daubert*).

73. See, e.g., *Heller v. Shaw Industries Inc.*, No. Civ.A. 95-7657, 1997 WL 535163, at *8 (E.D. Pa. Aug. 18, 1997) (Mem.) (stating, “in determining the validity of the methodology and principles underlying an expert’s opinion, the district court *should* take into consideration the following factors”) (emphasis added). The district court then listed eight total factors — the five observations of the Supreme Court in *Daubert* plus the three additional factors enumerated in *Paoli*. *Id.*

74. See *Daubert*, 509 U.S. at 582 at n.12 (citing *Downing*, 753 F.2d 1224, 1238-39; see also 3 J. Weinstein & M. Berger, WEINSTEIN’S EVIDENCE p 702-03 (1988); McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L.REV. 879, 911-12 (1982); *Symposium on Science and the Rules of Evidence*, 99 F.R.D. 187, 231 (1982)). See generally *Lust v. Merrell Dow Pharmaceuticals, Inc.*, 89 F.3d 594, 600 (9th Cir. 1996) (discussing *Paoli*’s methodology/conclusion distinction); *Ambrosini v. Labarraque*, 101 F.3d 129, 133 (D.C. Cir. 1996) (discussing *Paoli*’s emphasis on qualifications of the expert). Other courts have proposed criteria in addition to *Daubert*. See, e.g., *Lust*, 89 F.3d at 594 (noting that improper extrapolation may be proper basis for exclusion of testimony); *Braun v. Lorillard, Inc.*, 84 F.3d 230, 235 (7th Cir. 1996) (discussing that it is improper for testimony to be grounded in one methodology that is transposed from one area to a completely different area of inquiry); *Cavallo v. Star Enter.*, 892 F. Supp. 756, 800 (E.D. Va. 1995) (noting that expert reliance on anecdotal evidence alone may not survive “gate-keeping” scrutiny); *Porter v. Whitehall Labs., Inc.*, 9 F.3d 607, 615 (7th Cir. 1993) (noting that formation of expert conclusion solely on basis of temporal proximity is inconsistent with scientific method and therefore, inadmissible); *Chikovsky v. Ortho Pharmaceutical Corp.*, 832 F. Supp. 341, 350 (S.D. Fla. 1993) (holding

no opinion on the factor other than those enumerated in *Daubert*.⁷⁵

Although *Daubert* provides guidance for the admissibility of testimony based upon “scientific, technical or other specialized knowledge,” it does not hand judges a step-by-step guide for the application of scientific principles, nor does it provide bright-line standards governing admissibility.⁷⁶ Accordingly, trial judges have been left to subjectively apply the guidelines provided by the Rules of Evidence, *Daubert* and other binding precedent when exercising their “gate-keeping roles.”⁷⁷ As a result, different jurisdictions use varying approaches across product lines.⁷⁸ Some legal scholars as-

that expert evidence derived from insufficient connection between expert’s opinion and case is inadmissible).

75. See *Daubert*, 509 U.S. at 580.

76. See *Confronting the New Challenges of Scientific Evidence*, 108 HARV. L. REV. 1532, 1556-57 (1996) (commenting on *Daubert*’s failure to provide step-by-step guides for admissibility determinations); see also *Heller v. Shaw Industries Inc.*, 167 F.3d 146, 155 (3d Cir. 1999) (refusing to uphold requirement that expert must always rely upon published studies to reach conclusions on causation because “to so hold would . . . effectively resurrect a *Frye*-like bright-line standard”); *Kumho Tire Co. v. Carmichael et al.*, 526 U.S. 137, 140 (1999).

We do not believe that Rule 702 creates a schematism that segregates expertise by type while mapping certain kinds of questions to certain kinds of experts. Life and the legal cases that it generates are too complex to warrant so definitive a match Rather, we conclude that the trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable.

Id.; see also *Daubert*, 509 U.S. at 598 (C.J. Rehnquist concurring in part and dissenting in part) (stating that Court’s “general observations” are “vague and abstract”).

77. See FED. R. EVID. 702 (providing admissibility standards for expert testimony); see also *Daubert*, 509 U.S. at 594 (interpreting Rule 702 and discussing federal trial judge’s role as “gate keeper”). Rule 702 is not the only Rule of Evidence applicable to expert testimony. See, e.g., FED. R. EVID. 703, 706, & 403. In summary, these rules provide:

[A] judge assessing a proffer of expert scientific testimony under Rule 702 should also be mindful of other applicable rules. Rule 703 provides that expert opinions based on otherwise inadmissible hearsay are to be admitted only if the facts or data are “of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject.” Rule 706 allows the court at its discretion to procure the assistance of an expert of its own choosing. Finally, Rule 403 permits the exclusion of relevant evidence “if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury”

Daubert, 509 U.S. at 595.

78. See Richard J. Pierce, Jr., *Causation in Governmental Regulation and Toxic Torts*, 76 WASH. U.L.Q. 1307 (Winter, 1998) (discussing difference between causation requirements for regulation of toxic substances and causation requirements for liability in toxic tort cases). See, e.g., Capra, *supra* note 42, at 737 (arguing for less-restrictive approach to admissibility determinations under *Daubert*); Brown, *supra* note 47, at 1134 (promoting strict approach to admissibility determinations

sert that courts are excluding more testimony than is appropriate under *Daubert*.⁷⁹ One commentator noted that “post-*Daubert* writings, including . . . court opinions, have pushed the district courts in the direction of a more activist role in which the court conducts its own trial of the experts and excludes experts whom the court believes are wrong because their underlying methodology or evidence is controversial.”⁸⁰ Another scholar stated that trial judges

by stating that testimony is *only* admissible if it “can pass eight different gates”) (emphasis added).

In establishing liability in all jurisdictions and among all product lines, plaintiffs must prove causation. For a discussion of causation elements, see *supra* notes 6, 11, 26-35 and accompanying text and note 78. All tort law similarly requires that parties prove causation by a preponderance of the evidence, but the threshold of proof required for regulatory agencies is reasonably different and lower than that required in tort law. See *Sutera v. The Perrier Group of America*, 986 F. Supp. 655, 664 (D. Mass. 1997) (citing *Wright v. Williamette Indus.*, 91 F.3d 1105, 1107 (8th Cir. 1996)). For example, in *Sutera*, plaintiff sought to establish that benzene ingested through Perrier water caused cancer. *Id.* at 659. The court held that the plaintiff must prove, by a preponderance of the evidence, both general and specific causation. *Id.* The court rejected plaintiff’s “no-threshold” causation model. *Id.*

Regardless of the product line, however, the standards governing admissibility of causation evidence are not uniformly applied throughout the federal and state judiciary because both the federal government and regulatory agencies set differing exposure levels for toxic substances. See *Relkin*, *supra* note 31, at 2 (discussing exposure levels). *Relkin* notes that “in toxic tort actions[,] disputes naturally arise as to the import of the varied agency-set levels, particularly when exposure of a plaintiff is different from the exposure intended by the EPA or OSHA.” *Id.* at 2. While governmental levels are somewhat instructive, courts do not assume that exposure to levels below these set levels is trivial or that exposure at levels that exceed these set levels is proof of causation. See *id.* at 5. As a result, courts have inconsistently given weight to governmental levels across product lines. See *Gideon v. Johns Manville Sales Corp.*, 761 F.2d 1129, 1131 (5th Cir. 1985) (using OSHA’s standard for permissible airborne exposure and finding for defendant because plaintiff was exposed at levels below this standard); *Quinn v. Amphenol Corp.*, No. 94-1631, 1995 U.S. App. LEXIS 30788 (4th Cir. Oct. 26, 1995) (using toxicity levels for trichloroethylene promulgated by EPA and Department of Health and Environmental Control but nevertheless affirming dismissal of plaintiff’s claims even though exposure exceeded such levels); *German v. Federal Home Loan Mortg. Corp.*, 885 F. Supp. 537, 559 (S.D.N.Y. 1995) (using toxicity levels for lead promulgated by Center for Disease Control and denying defendant’s motion for summary judgement even though plaintiff’s exposure did not reach such levels).

79. See Anthony Z. Roisman, *Expert Testimony After Daubert*, SA85 ALI-ABA 353, 356 (1996) (discussing that district court judges have taken overly activist role in determining admissibility).

80. *Id.* Roisman further notes:

This trend has encouraged district courts not only to resolve general issues such as whether an expert properly relied upon the kind of evidence appropriate for the opinion offered, or in general, used the appropriate scientific methodology, but also very narrow and specific questions such as whether the expert’s opinion about the significance of a particular study is right and whether the expert has given proper weight to contrary evidence.

Id. (citation omitted).

may not elevate themselves to the role of “St. Peter at the gates of heaven, performing a searching inquiry into the depth of an expert witness’ soul—separating the saved from the damned.”⁸¹ Other commentators applaud the most restrictive scrutiny with respect to admissibility of expert causation testimony on the grounds that judges need to separate the “scientific wheat from the charlatan chaff.”⁸²

D. Proving Causation with Novel Methodologies

Despite the varying standards with which courts scrutinize expert testimony, the results of such scrutiny in toxic tort litigation are relatively uniform—testimony of causation experts is largely excluded.⁸³ The scientific uncertainty regarding the causal relationship between exposure to a particular substance and plaintiff’s injuries undoubtedly contributes to the exclusion of expert evidence.⁸⁴ The exclusion of expert evidence is especially problematic for toxic tort plaintiffs in the environmental context where plain-

81. See Capra, *supra* note 42, at 737 (discussing shortcomings of expert evidence admissibility standards). Some commentators argue that plaintiffs should not be required to prove causation at all because the present nature of causation standards in toxic torts negatively impacts plaintiffs. See Margaret A. Berger, *Eliminating General Causation: Notes Toward a New Theory of Justice and Toxic Torts*, 97 COLUM. L. REV. 2117 (1997) (arguing that plaintiffs should no longer be required to prove causation in toxic tort cases). Another scholar notes:

Under Berger’s proposal, a plaintiff could recover from a firm that exposes her to a toxic substance simply by proving that she suffered an injury of a type that might be attributable to such exposure and that the firm did not adequately test the substance to determine its toxic effects or did not adequately warn the public of those effects.

Pierce, *supra* note 78, at 1310.

82. See Buckley and Haake, *supra* note 3 (stating that “the litany of toxic tort cases decided after *Daubert* demonstrates [that] the American judicial system [is] quite capable of assessing the validity of expert testimony . . . and separating the scientific wheat from the charlatan chaff”).

83. See Lin *supra* note 4, at 565 (discussing that *Daubert* led to various outcomes). Others have commented on the effect *Daubert* has on the exclusion of testimony:

Even before *Daubert* was handed down, it was predicted that many federal district courts would read the decision as requiring their active and searching involvement in reviewing challenges to scientific evidence, especially evidence proffered to link allegedly hazardous substances to specific disease conditions. These courts have taken advantage of both the substantive and procedural flexibility offered by *Daubert*. They have rejected speculative testimony, playing on a general fear of controversial substances, and subjected proposed causality testimony to scrutiny and challenge by party and independent experts in extensive Rule 104 hearings.

See Miller & Rein, *supra* note 7, at 571-72.

84. See Pierce, *supra* note 78, at 1037 (discussing difficulties plaintiffs encounter in proving causation in toxic tort litigation).

tiffs must prove, for example, that a chemical spill, emission or other exposure caused injury.⁸⁵ While it seems that the use of certain sciences and methodologies by plaintiffs may aid in the nearly impossible task of establishing causation, the employment of these “novel sciences” may simultaneously cause a court to reject the proffered testimony under *Daubert*.⁸⁶ These “novel” methodologies upon which experts rely to establish that a particular substance caused an injury include: 1) epidemiological studies; 2) case studies; 3) in vivo and in vitro animal studies and 4) pharmacological studies.⁸⁷

The study of epidemiology seeks to determine the causes of disease in humans.⁸⁸ With respect to the establishment of causation in toxic tort litigation, this science is aimed at proving general, as opposed to specific, causation.⁸⁹ In the environmental context, for example, epidemiologists attempt to prove that exposure to an alleged toxic substance is (or is not) sufficient to cause injury to humans by comparing “control groups of unexposed individuals to groups of individuals exposed to a hypothetical cause of the disease being studied to determine whether exposed individuals have a greater risk of manifesting that disease.”⁹⁰ After compiling the results of an epidemiological study, an epidemiologist can derive a “relative risk ratio” which “compares the incidence of disease occurrence in exposed individuals to the incidence of disease occurrence in unexposed individuals.”⁹¹ The higher the ratio, the more likely it is that a particular case of a disease was associated with the exposure.⁹² Most commentators and courts agree that results of epidemiological studies are the most helpful and relevant evidence in determining general causation in a toxic tort case.⁹³

85. For discussion of causation elements in toxic tort cases, see *supra* notes 6, 11, 26-35 and accompanying text and note 78.

86. For discussion of novel sciences in establishing causation and the corresponding admissibility problems, see *infra* notes 87-129 and accompanying text.

87. See Buckley & Haake, *supra* note 3 (describing methodologies upon which experts base conclusions in toxic tort litigation).

88. See *id.* (discussing science of epidemiology).

89. See *id.* (citing Linda Bailey et al., *Reference Guide on Epidemiology*, in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 126 (Federal Judicial Center 1994)).

90. See Hall v. Baxter Healthcare Corp., 947 F. Supp. 1387, 1403 (D.Or. 1996) (discussing roles of epidemiologists).

91. See Buckley & Haake, *supra* note 3 (discussing relative risk ratios in epidemiological studies).

92. See *id.* (noting that higher relative risk ratio indicates higher risk of exposure).

93. See *id.* (noting that epidemiological studies are considered the most helpful); see also *In re Agent Orange Products Liability Litigation*, 611 F. Supp. 1223,

Although courts have found significant epidemiological evidence to be helpful, *Daubert* may still preclude admissibility.⁹⁴ Courts require plaintiffs to prove that a particular substance more likely than not caused the plaintiff's injury.⁹⁵ An epidemiological study, therefore, must produce a relative risk ratio of greater than two (which means that there is more than a fifty-per-cent chance that the exposure was associated with the disease in question) in order to establish general causation by a preponderance of the evidence.⁹⁶ Most likely, if the evidence fails this test, it will be excluded under *Daubert* as unreliable.⁹⁷

Although on remand the Ninth Circuit in *Daubert* held that a relative risk ratio of greater than two is not an absolute prerequisite when establishing causation, courts have generally disallowed evidence that does not meet this standard.⁹⁸ If epidemiological studies, standing alone, would be insufficient to establish causation, experts may try to combine the insufficient results with the results of other epidemiologic, clinical or scientific studies in an attempt to withstand the rigors of *Daubert* scrutiny.⁹⁹ History tells us, however, that such efforts may be futile.¹⁰⁰ Several examples may provide evidence of such skepticism.

1239 (E.D.N.Y. 1985) (noting that results of epidemiologic studies can be of critical importance when establishing causation).

94. See *General Electric v. Joiner*, 864 F. Supp. 1310, 1326-27 (N.D. Ga. 1994) (holding that epidemiological evidence is insufficient under *Daubert*); see also *Buckley & Haake*, *supra* note 3 (discussing that epidemiological evidence will not always survive *Daubert*).

95. See *Daubert II*, 43 F.3d 1311, 1321 (9th Cir. 1995) (quoting *DeLuca v. Merrell Dow Pharm., Inc.*, 911 F.2d 941, 958 (3d Cir. 1990)). The *Daubert II* court noted that "for an epidemiological study to show causation under a preponderance of the evidence standard, 'the relative risk ratio of limb reduction defects arising from the epidemiological data . . . will, at a minimum, have to exceed [two].'" *Id.*

96. See *Daubert II*, 43 F.3d at 1321 (discussing relative risk ratios in epidemiologic studies); see also *Buckley & Haake*, *supra* note 3 (noting that relative risk ratio of greater than two means that there is more than a 50% chance that exposure was associated with disease in question).

97. For discussion of *Daubert*'s reliability standards, see *supra* notes 56-58, 61-65 and accompanying text.

98. See *Daubert II*, 43 F.3d at 1321 (noting that courts should not automatically exclude evidence having relative risk ratios less than two). Nevertheless, the Ninth Circuit in *Daubert* excluded evidence having a relative risk ratio of less than two. *Id.*

99. See *Buckley & Haake*, *supra* note 3 (discussing methodologies in addition to epidemiologic studies that experts may employ to establish causation).

100. For discussion of novel sciences that courts have held insufficient to establish causation under *Daubert*, see *supra* notes 87-99 and accompanying text, and see *infra* notes 101-29 and accompanying text.

In *Casey v. Ohio Medical Products*,¹⁰¹ a 1995 decision from the Northern District of California, the plaintiff attempted, through the introduction of a compilation of case studies, to prove that exposure to halothane while working as an anesthesiologist caused him to contract hepatitis.¹⁰² The court held that the expert testimony did not satisfy the *Daubert* requirements because case studies “simply describe reported phenomena without comparison to the rate at which the phenomena occur in the general population . . . do not isolate and exclude potentially alternative causes; and do not investigate or explain the mechanism of causation.”¹⁰³

Similarly, courts have held that causation evidence derived from animal testing will not usually satisfy the *Daubert* requirements.¹⁰⁴ Toxicological studies, based upon animal testing, are often used in order to assess how much of a particular substance is harmful, if at all, to humans.¹⁰⁵ In drawing conclusions, scientists study the effects upon animals of exposure to high levels of toxins, extrapolate an incidence of disease at lower, more realistic levels and translate the results of the extrapolation into an expression of human risk.¹⁰⁶ However, the results of such studies have a very limited impact on causation in toxic tort cases.¹⁰⁷ The Eastern District of New York held in *In re Agent Orange Products Liability Litigation* that “[t]he animal studies are not helpful in the instant case because they involve different biological species. They are of so little probative force and are so potentially misleading as to be inadmissible.”¹⁰⁸ Some commentators state that the use of “animal toxicity

101. 877 F. Supp. 1380, 1385 (N.D. Cal. 1995).

102. *See id.*

103. *Id.* at 1385; *see also* Hall v. Baxter Healthcare Corp., 947 F. Supp. 1387, 1411 (D.Or. 1996) (stating that case studies are insufficient basis upon which to make causation conclusions); *see also* Buckley & Haake, *supra* note 3 (discussing case studies).

104. *See Casey*, 877 F.Supp. at 1385 n.94 (citing *In re Agent Orange Prod. Liab. Litig.*, 611 F. Supp. 1223, 1241 (E.D.N.Y. 1985); *National Bank of Commerce v. Dow Chem. Co.*, 965 F. Supp. 1490, 1527 (E.D. Ark. 1996); Jack L. Landau & Hugh O’Riordan, *Of Mice and Men: The Admissibility of Animal Studies to Prove Causation in Toxic Tort Litigation*, 25 IDAHO L. REV. 521, 523 (1989)).

105. *See Casey*, 877 F.Supp. at 1385 (discussing goals of toxicological studies).

106. *See* Landau & O’Riordan, *supra* note 104, at 536-37 (discussing methodologies employed in toxicology).

107. *See* General Electric v. Joiner, 864 F. Supp. 1310, 1326-27 (N.D. Ga. 1994) (holding that animal studies linking high doses of chemical to liver cancer did not satisfy *Daubert*).

108. *In re Agent Orange*, 611 F. Supp. at 1241; *see also* Buckley & Haake, *supra* note 3 (listing cases with similar holdings on the causation issue).

studies to prove causation in toxic tort trials is dangerous and improper.”¹⁰⁹

Evidence from pharmacological studies provides another basis upon which experts often rely when reaching causation conclusions in toxic tort litigation.¹¹⁰ Pharmacology involves the comparison of the chemical structure of compounds with known toxicity levels to chemical structures of compounds of unknown toxicity in order to estimate the toxicity of the latter.¹¹¹ Results based upon such comparisons, however, when proffered as causation evidence, rarely survive *Daubert* scrutiny because such studies are often conflicting and experts can rarely provide a scientifically valid basis for making comparisons between chemical structures.¹¹²

Plaintiffs and experts also tried to establish causation with evidence derived from a differential diagnosis and from evidence obtained by clinical ecologists.¹¹³ Differential diagnosis is the “basic method of internal medicine.”¹¹⁴ Courts have held that “when a doctor employs standard diagnostic techniques, his or her testimony is much more readily admissible.”¹¹⁵ The Third Circuit held in *Paoli* that doctors arriving at novel conclusions should be able to testify thereto as long as the techniques employed which led to the conclusion are reliable.¹¹⁶ The *Paoli* court also noted that differential diagnosis is a reliable basis upon which to base conclusions.¹¹⁷ Part of a reliable differential diagnosis, however, involves ruling out

109. Landau & O’Riordan, *supra* note 104, at 523 (discussing use of animal testing as evidence in toxic tort cases).

110. See Buckley & Haake, *supra* note 3 (discussing use of pharmacology in toxic tort litigation); see also Bernard D. Goldstein & Mary Sue Henifin, *Reference Guide on Toxicology*, in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 185 (Federal Judicial Center 1994) (discussing use of pharmacology as evidence).

111. See Buckley & Haake, *supra* note 3 (discussing methodologies of pharmacology).

112. See *National Bank of Commerce v. Dow Chem. Co.*, 965 F. Supp. 1490, 1526 (E.D. Ark. 1996) (excluding pharmacological evidence); *Schudel v. General Elec. Co.*, 120 F.3d 991, 997 (9th Cir. 1997) (excluding testimony because expert failed to establish that it was scientifically acceptable to draw general conclusions about the toxicity of chemicals in question from studies of other chemicals).

113. See Buckley & Haake, *supra* note 3 (discussing differential diagnosis and clinical ecology); see also *Heller v. Shaw Industries, Inc.*, 167 F.3d 146, 156 (3d Cir. 1999) (discussing expert’s use of differential diagnosis).

114. See *In re Paoli R.R. Yard PCB Litigation*, 35 F.3d 717, 755 (3d Cir. 1994).

115. *Id.* at 759 n.27 (discussing importance of diagnostic techniques).

116. See *id.*

117. See *id.*; see also *Baker v. National Health Products, Inc.*, 896 F. Supp. 100, 102 (N.D.N.Y. 1995) (admitting expert evidence based partly on differential diagnosis).

alternative possible causes of an injury.¹¹⁸ While a plaintiff's expert is usually not required to eliminate all possible alternative causes, if a defendant points to a possible alternative cause, and plaintiff's expert can offer *no explanation*, plaintiff's differential diagnosis will likely be inadmissible.¹¹⁹ For example, in the 1999 Third Circuit case, *Heller v. Shaw Industries, Inc.*,¹²⁰ plaintiff claimed that exposure to chemical emissions from carpeting caused the injury.¹²¹ Plaintiff offered causation testimony based partly upon differential diagnosis.¹²² The defendant pointed to possible alternative causes of plaintiff's injury.¹²³ The Third Circuit in *Heller* held that plaintiff's expert offered more than "no explanation," but the court nevertheless excluded the evidence as unreliable.¹²⁴ Similarly, differential diagnosis presents problems for environmental toxic tort plaintiffs because it is unlikely that an expert will be able to rule out or at least minimize the probability of contribution to causation for every alternative cause a defendant offers.¹²⁵ Furthermore, differential diagnosis offers evidence only for specific causation, and while such evidence may be helpful, it will undoubtedly be insufficient to establish a claim.¹²⁶

118. See *Paoli*, 35 F.3d at 579 n.27 (discussing differential diagnosis as scientific evidence).

119. See *id.*

120. See *Heller*, 167 F.3d at 156 (emphasis added) (discussing defendant's role in rebutting results of differential diagnosis performed by plaintiff's expert); see also *Paoli*, 35 F.3d at 759 (noting that defendants can point to possible alternative causes); *Claar v. Burlington N. R.R. Co.*, 29 F.3d 499, 502 (9th Cir. 1994) (excluding testimony because plaintiff's expert offered no explanation when defendant pointed to possible alternative causes of plaintiff's injuries); *Cavallo v. Star Enter.*, 892 F. Supp. 756, 771 (E.D. Va. 1995) (discussing admissibility requirements for differential diagnosis).

121. See *Heller*, 167 F.3d at 151 (discussing plaintiff's cause of action).

122. See *id.* (discussing expert's offer of differential diagnosis as evidence).

123. See *id.* at 156-57 (discussing plaintiff's expert's differential diagnosis and defendant's challenge).

124. See *id.* at 156 (holding that district court wrongly excluded evidence on grounds that plaintiff failed to rule out all possible alternative causes). The Third Circuit determined that an expert need only offer more than "no explanation" in response to a challenge by defendant. See *id.* at 156-57. In *Heller*, the court determined that plaintiff's expert offered more than "no explanation." See *id.* The Third Circuit, however, affirmed the exclusion of the expert on reliability grounds. See *id.*

125. See *Cavallo*, 892 F. Supp. at 771 (stating that if "other possible causes of an injury cannot be ruled out, or at least the probability of their contribution to causation minimized, then the 'more likely than not' threshold for proving causation may not be met").

126. See *Buckley & Haake*, *supra* note 3 (discussing seeming inadequacy of differential diagnosis in proving causation). For discussion of specific causation and its role in establishing liability in toxic tort cases, see *supra* notes 29-35 and accompanying text.

Toxic tort plaintiffs sometimes offer causation evidence based upon clinical ecology.¹²⁷ “Clinical ecology is a relatively new and controversial field of medicine.”¹²⁸ Under a toxic tort theory, plaintiff may seek, with expert testimony, to establish that exposure to a substance released by the defendant has resulted in Multiple Chemical Sensitivity (MCS), a condition brought on by “various kinds of environmental insults [that] depress a person’s immune system so that the exposed person . . . becomes hypersensitive to other chemicals and naturally occurring substances.”¹²⁹ Apparently because of the novelty of the condition and the unwillingness to recognize clinical ecology as a valid science, courts have held without exception that evidence proffered to establish causation of MCS does not withstand *Daubert*.¹³⁰

Unless toxic tort plaintiffs can introduce as causation evidence an epidemiological study resulting in a relative ratio of greater than two (which, incidentally, would only contribute to a general causation conclusion), it seems that they could be “out of luck” if they try to establish causation under any of the aforementioned scientific methodologies or theories.¹³¹ If these documented methodologies cannot survive a *Daubert* inquiry, from what other sources can a plaintiff extrapolate valid causation evidence? “Which way do we go, Judge?” Maybe the answer will not be found by differently applying or moderating scientific theories, but by arguing differently the legal standards by which courts govern the admissibility of such evidence.¹³²

II. ARGUING *DAUBERT* FROM A DIFFERENT ANGLE

A. Plaintiffs may find help within *Daubert* itself

In *Daubert*, the Supreme Court noted that a number of authorities, have offered additional factors that are intended to “help”

127. See Buckley & Haake, *supra* note 3 (discussing clinical ecology as evidence of causation in toxic torts).

128. *Id.*; see also Lin, *supra* note 4, at 584-85 (noting that “even clinical ecology has found its way into some litigation, despite vociferous criticism by mainstream medicine”).

129. See *id.*

130. See Buckley & Haake, *supra* note 3 (noting that courts have universally held that MCS evidence does not survive *Daubert*).

131. For discussions of different scientific methodologies with which P’s seek to establish causation, see *supra* notes 87-128 and accompanying text.

132. For discussion of the different applications of legal standards, see *infra* notes 139 and accompanying text.

courts address the reliability of testimony.¹³³ The Court acknowledged that different versions of factor sets may have some merit and may bear on the inquiry, but nevertheless, the Court “made clear that the district court’s gate-keeper role is a flexible one and that [such factors] are simply useful signposts, not dispositive hurdles that a party must overcome in order to have expert testimony admitted.”¹³⁴ The *Daubert* Court, therefore, refused to establish a definitive checklist or test.¹³⁵

The Supreme Court recognized with confidence the ability of federal judges to undertake the responsibility of determining whether testimony is admissible.¹³⁶ Nevertheless, the Court stressed, “that while *Daubert* assigns trial judges the role as gate keepers, it does not authorize trial judges to act as ‘super-experts,’ or to scrutinize experts in such a way as to exclude all but the perfect expert testimony.”¹³⁷ In other words, “shaky” but admissible evidence should be attacked by cross-examination, instruction on

133. See *Daubert*, 509 U.S. at 594 n.12 (citing as examples: *United States v. Downing*, 753 F.2d 1224, 1238-39 (3d Cir. 1985); 3 WEINSTEIN & BERGER 702, 702-42; McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L. REV. 879, 911-12 (1982); and *Symposium on Science and the Rules of Evidence*, 99 F.R.D. 187, 231 (1983) (statement by Margaret Berger)). Capra stipulates:

After *Daubert*, the courts have focused on several factors other than those listed in the *Daubert* opinion, that are considered relevant to whether an expert’s testimony is unreliable and hence inadmissible. The factors include: (1) improper extrapolation—drawing an unaccepted conclusion from an accepted premise, (2) reliance on anecdotal evidence—basing an opinion solely on personal experience with patients or on a few case studies, (3) reliance on temporal proximity—basing a conclusion about causation on the short time span between exposure to a substance and the subsequent inquiry, (4) dissonance between expert testimony and the facts of the case, (5) failure to consider other causes, (6) lack of testifying, and (6) [sic] subjectivity—not being able to explain a methodology in objective terms. None of these factors is considered dispositive, but each has been considered as cutting against admissibility.

Capra, *supra* note 42, at 714. For further discussion of courts’ attempts to more conclusively define *Daubert*, see *supra* notes 67-75 and accompanying text.

134. *Heller*, 167 F.3d at 152; see also *Daubert*, 509 U.S. at 595 n. 12 (stating “[T]o the extent that [the additional factors] focus on the reliability of the evidence as ensured by the scientific validity of its underlying principles, all of these versions may have merit, although we express no opinion regarding any of their particular details”).

135. See *id.* (stating “we do not presume to set out a definitive check list or test”). For further discussion of *Daubert*’s vagueness and open-endedness, see *supra* notes 67-68 and accompanying text.

136. See *Daubert*, 509 U.S. at 593 (recognizing ability of federal judges to determine whether expert testimony is admissible).

137. Capra, *supra* note 42, at 735.

the burden of proof and presentation of contradictory evidence.¹³⁸ Although it provides federal judges with some discretion, *Daubert* does not, work a “seachange over federal evidence law[;] . . . the trial court’s role as gate keeper is not intended to serve as a replacement for the adversary system.”¹³⁹ Stated in a different way, courts should avoid, when determining admissibility of expert testimony, evaluating witness credibility and weighing the evidence—“the ageless role of the jury.”¹⁴⁰

Plaintiffs seeking to establish causation in toxic tort may wish to bring to the court’s attention that the Rules of Evidence were intended to be applied with a “liberal thrust.”¹⁴¹ They may want to point out that the majority in *Daubert* did not intend their “guidelines” to be applied dispositively.¹⁴² Plaintiffs may also maintain the *Daubert* factors are not worthy of absolute judicial reliance.¹⁴³ While concurring in part and dissenting in part with respect to the majority’s opinion in *Daubert*, Chief Justice Rehnquist with whom Justice Stevens joined, asserted that the “general observations” offered by the majority were “vague and abstract.”¹⁴⁴ Rehnquist also implied that the proliferation of such standards was unfortunate considering the fact that “general observations” by the Supreme Court “customarily carry great weight with the lower federal courts.”¹⁴⁵

B. Other courts and commentators offer additional pro-plaintiff arguments

Toxic tort plaintiffs may try to demonstrate a recent tendency by the higher courts’ to somewhat retract the gate-keeping respon-

138. See *Daubert*, 509 U.S. at 596 (stating that “vigorous cross-examination, presentation of contradictory evidence, and careful instruction on the burden of proof are the traditional means of attacking shaky but admissible evidence”).

139. *United States v. 14.38 Acres of Land*, 80 F.3d 1074, 1080 (5th Cir. 1996) (holding that district court, by excluding certain evidence, abused its discretion by applying too rigidly the reliability test).

140. See Capra, *supra* note 42, at 737.

141. See *Daubert*, 509 U.S. at 590 (noting that the Federal Rules intended a “liberal thrust”).

142. See *id.* at 593 (stating that Court did not intend to set out definitive test or checklist).

143. See *id.* at 598 (C.J. Rehnquist joined by J. Stevens concurring in part and dissenting in part) (noting that majority’s “general observations” are “vague and abstract”).

144. See *id.*

145. See *id.*

sibilities of district court judges.¹⁴⁶ For example, the Third Circuit in *Heller*, effectively extinguished any inclination the district court may have had to rigidly apply the *Daubert*/*Paoli* factors as a test for admissibility in the future.¹⁴⁷ Plaintiffs could argue that *Heller* is a slight departure from the Third Circuit's prior holding in *Paoli* which more narrowly interpreted Rule 702 by providing the district court with additional grounds for excluding testimony.¹⁴⁸ The Third Circuit in *Heller*, chose to evaluate the reliability and rele-

146. For discussion of this possible trend, see *infra* notes 145-52, 162-66 and accompanying text.

147. See *Heller v. Shaw Industries, Inc. (Heller II)*, 167 F.3d 152, 154 (3d Cir. 1999) (holding that *Daubert* factors are simply signposts, not dispositive hurdles party should have to overcome); *but see Kent v. Howell Electric Motors, et al.*, No. 96-7221, 1999 U.S. Dist. LEXIS 10940, at *11 (E.D. Pa. July 20, 1999) (excluding expert causation testimony and granting summary judgment because expert failed to rule out reasonable alternative theories of causation suggested by defendant). The United States District Court for the Eastern District of Pennsylvania apparently interpreted *Heller II* to have established a rule prohibiting experts from testifying when the expert is unable to offer explanations for defendant's suggestions of alternative possible causes. *Id.* The *Kent* court noted, "[o]ne minimum reliability threshold seems to have emerged: for his testimony to be reliable, an expert must rule out obvious alternative causes." *Kent*, 1999 U.S. Dist. LEXIS 10940, at *12 (citing *Heller II*, 167 F.3d at 156).

It appears, at first, that the Eastern District, with its decision in *Kent*, did not heed the Third Circuit's implied "warning" against overzealous "gate keeping." See *Heller II*, 167 F.3d at 152 (holding that courts should apply factors flexibly). It seems that the district court applied the "nondispositive" factors dispositively, found that the testimony did not fit all of *Daubert*'s general observations and *Paoli*'s factors and consequently excluded it. See *Kent*, 1999 U.S. Dist. LEXIS 10940, at *23-24. This is not, however, how the district court disposed of the plaintiff's witness. *Id.* at *12.

The district court in *Kent* acknowledged *Kumho Tire*, which held that the *Daubert* factors may not be applicable in every case. See *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 140 (1999). The district court employed this rationale in its decision in *Kent*: "[a]s the Court in *Kumho* predicted, some of the *Daubert* factors are inapplicable to this methodology Similarly, some of the *Downing* factors bear little significance." *Kent*, 1999 U.S. Dist. LEXIS 10940, at *18. Nevertheless, the district court applied the remainder of the applicable factors to the expert's testimony in question. See *id.* If the court's inquiry ended at that juncture, the expert's methodology would have likely been reliable. See *id.* In the end, however, the district court excluded the expert's testimony because the expert failed to rule out alternative causes suggested by the defendant. *Id.*

The *Heller II* court interpreted this "threshold" to operate only if the expert offered no explanation for the alternative causation theories suggested by the defendant. See *Heller II*, 167 F.3d at 156 (holding that although plaintiff's expert did not offer detailed explanations to rebut defendant's suggested alternative theories of causation, he certainly offered more than "no explanation"). *Kent* is not in conflict with *Heller II*, however, and is, therefore, not an attempt by the district court to overzealously exercise its "gate[-]keeping" responsibilities. The district court stated specifically, "[the expert] offered no explanation at all to rebut [defendant's] theories." *Kent*, 1999 U.S. Dist. LEXIS 10940, at *18 (emphasis added).

148. See *Paoli*, 35 F.3d at 742 n. 8 (listing admissibility criteria in addition to *Daubert*'s general observations).

vancy of testimony by viewing it in its entirety, as opposed to breaking the evidence up in order to determine whether specific aspects of the testimony met the *Daubert/Paoli* factors.¹⁴⁹ The Third Circuit implied that federal judges should step back from their role as “testimony excluders” and look at the proffered testimony as a whole.¹⁵⁰ The federal standard should call on judges to examine the testimony as “gate keepers” under the reliability and relevancy requirements which favor admissibility while maintaining the respective roles of the judge and jury in the adversarial process as the Federal Rules intended.¹⁵¹ The *Heller* court noted:

We have held that the reliability analysis applies to all aspects of an expert’s testimony: the methodology, the facts underlying the expert’s opinion, the link between the facts and the conclusion, et alia. However, not only must each stage of the expert’s testimony be reliable, but each stage must be evaluated practically and flexibly without bright-line exclusionary (or inclusionary) rules.¹⁵²

Clearly the Third Circuit implied that district court judges need to exercise their discretion to an extent in order to prevent juries from being misled by “junk science.”¹⁵³ In reviewing the trial court’s decision for abuse of discretion, the Third Circuit noted, however, that the district court judge had too strictly applied some of the *Daubert/Paoli* factors.¹⁵⁴

149. See *Heller II*, 167 F.3d at 159 (holding that conclusions drawn did not reliably flow from methodology and facts at issue).

150. See *id.* at 152 (holding that by listing *Daubert* factors, Supreme Court did not intend to obscure fact that district court’s gate-keeper role is flexible one).

151. See *id.* (holding that vigorous cross examination and other safeguards of adversary system are appropriate means of attacking shaky evidence that is otherwise admissible). For discussion of adversary safeguards and respective roles of the judge and jury with respect to attacking expert evidence, see *supra* note 160-62 and accompanying text.

152. *Id.* at 155. (citation omitted) The ideas embodied in *Heller II* are consistent with the Supreme Court’s most recent decision interpreting the requirements of *Daubert* and Rule 702. Cf. *Kumho Tire Co., v. Carmichael*, et al., 526 U.S. 137, 140 (concluding that “relevant reliability inquiry ‘should be ‘flexible,’ that its ‘overarching subject [should be] . . . validity and reliability,’ and that ‘*Daubert* was intended neither to be exhaustive nor to apply in every case’”).

153. See *Daubert*, 509 U.S. at 594 (discussing need for inquiry into reliability and relevancy of expert testimony); *Kumho Tire*, 526 U.S. at 140 (discussing that reliability inquiry is necessary); *Heller*, 167 F.3d 146, 152-52 (discussing *Daubert* requirements).

154. See *Heller*, 167 F.3d at 158, 164-65 (noting that district court erred in excluding certain aspects of evidence offered by plaintiff’s experts but ultimately holding that district court was correct in excluding their testimony because, overall, their conclusions did not reliably flow from methodologies employed).

The U.S. Supreme Court, since *Daubert*, has implied that its “general observations” should not be taken too seriously.¹⁵⁵ Less than four years after the Court decided *Daubert*, it heard *General Electric Co. v. Joiner*.¹⁵⁶ The majority held that under an abuse of discretion standard, the district court was correct to exclude plaintiff’s expert who opined that PCB tests on laboratory mice were relevant to prove that such substances caused cancer in humans.¹⁵⁷ The Court held that there was “simply too great an analytical gap between the data and the opinion proffered.”¹⁵⁸ In other words, the Court determined that the methodologies employed by experts and the conclusions they generate are not entirely distinct from one another.¹⁵⁹ Justice Stevens, on the other hand, disagreed in part with the majority.¹⁶⁰ In the dissenting portion of his opinion, he maintained that the majority’s decision effectively invited judges to resolve questions regarding credibility and weight of expert evidence.¹⁶¹ These questions, Stevens adamantly stated, are within the province of the jury.¹⁶² One commentator noted:

Stevens is undoubtedly correct in his assessment of the mischief that may lurk in the [majority’s] observations. Following *Daubert*, the two remaining protections restraining overzealous federal judges from intruding on the jury’s fact finding responsibility were the methodology-conclusion distinction and effective appellate review. By diluting both of these protections, *Joiner* may provide cover for judges who simply do not believe the expert’s testimony. As a result, *Joiner* may further the unfortunate erosion of the role of the jury.¹⁶³

This commentator, Jeffery Robert White, an associate general counsel with the Association of Trial Lawyers of America, also expressed his hope that the next time the Court offered some “gen-

155. For discussion of the application of the Court’s “general observations” since *Daubert*, see *infra* notes 165-66 and accompanying text.

156. See *General Elec. Co. v. Joiner*, 522 U.S. 136, 142 (1997).

157. See *id.* at 141-43 (discussing standard of review and holding).

158. *Id.* at 143.

159. See *id.* (discussing holding).

160. See *id.* at 145 (J. Stevens concurring in part and dissenting in part) (refusing to join in part of majority opinion which discusses admissibility standards under *Daubert*).

161. See *id.* at 145-46 (discussing flaws in majority’s opinion with respect to the exclusion of plaintiff’s experts).

162. See *id.*

163. Jeffery Robert White, *Experts and Judges*, 34-SEP TRIAL 91, *92.

eral observations,” such observations would remind the lower federal courts to uphold the adversary system and allow the jury to do its job.¹⁶⁴

White may have gotten his wish. In 1999, the Court handed down its decision in *Kumho Tire Co., Ltd. v. Carmichael*.¹⁶⁵ A careful reading of *Kumho* may provide toxic tort plaintiffs with all of the ammunition they need to try to convince district court judges to relax their application of the *Daubert* factors and more readily admit novel scientific testimony.¹⁶⁶ The *Kumho* Court held that the Federal Rules of Evidence, specifically Rule 702, do not create a “schematism that segregates expertise by type while mapping certain kinds of questions to certain kinds of experts. Life and the legal cases that it generates are too complex to warrant too definitive a match.”¹⁶⁷ The Court noted that the “gate-keeping role” of trial judges is important, but in exercising discretion, trial judges should consider the specific *Daubert* factors only when they are “reasonable measures of the reliability of expert testimony.”¹⁶⁸ Because of the unique nature of causation requirements in toxic torts, plaintiffs may argue that many of the *Daubert* factors are unreasonable measures of reliability — especially where experts must testify as to novel sciences.¹⁶⁹

III. WHICH WAY DO YOU GO, JUDGE?

An assessment of relevant case law leads to the ultimate conclusion that admissibility determinations are left with the trial judge.¹⁷⁰ Most appellate courts afford the trial judges’ decisions, with respect

164. See *id.* at *94 (promoting need for adversary system).

165. See *Kumho Tire Co., Ltd., v. Carmichael*, 526 U.S. 137, 143 (1999) (discussing application of *Daubert* to non-scientific evidence).

166. See *id.* at 146 (discussing need for flexible application of the *Daubert* factors).

167. *Id.* at 146.

168. See *id.* (emphasis added). It is also important to note that the Court in *Kumho* maintained that the trial judge has broad latitude to determine whether the *Daubert* factors are reasonable measures of reliability. See *id.*

169. See *id.* (discussing that *Daubert* factors should only be used to assess reliability when it is reasonable). Plaintiffs proffering evidence based upon novel sciences should argue that the *Daubert* factors are unreasonable measures of reliability because the *Daubert* factors are not conducive to permitting such evidence even if the evidence is otherwise reliable. For example, many novel sciences have not had the chance to be peer reviewed or otherwise tested outside of the litigation context.

170. For discussion of district court judge’s role as “gate keeper,” see *supra* notes 61, 76-77, 79-82, 132, 134, 138, 166 and accompanying text.

to admissibility or exclusion, much discretion.¹⁷¹ This Comment is not intended to suggest that courts *will* consider the arguments favoring admissibility with respect to toxic tort causation evidence grounded in novel sciences; this Comment is merely intended to demonstrate that a strict application of the *Daubert* factors will inevitably render most causation evidence inadmissible.¹⁷²

Daubert scholars and many other members of the legal community are beginning to recognize that certain admissibility standards are hostile to plaintiffs seeking to establish causation based upon novel sciences.¹⁷³ The need to keep “junk science” out of the courtroom, however, hinders judges from taking a liberal view on admissibility and fully considering the causation problems with which toxic tort plaintiffs are confronted.¹⁷⁴ Thus, the toxic tort plaintiff is faced with the question, “Which way do we go, Judge?”

While admissibility issues could be resolved by “forging a new tort doctrine to deal with causal uncertainties,” courts have refused to move in that direction.¹⁷⁵ Presently, the only appropriate advice one can provide to toxic tort plaintiffs who seek to offer expert evidence based upon novel science is as follows: “Hire your expert wisely. Be sure that the court will find your expert credible and her opinion well founded. At the very least, understand how the expert formulated her opinion regarding . . . causation. Find all scientific literature that supports the methodology by which your expert

171. See *Joiner*, 522 U.S. at 141 (discussing that proper standard of review is “abuse of discretion standard”); see also *Kumho Tire*, 526 U.S. at 146 (noting that trial judge has considerable discretion in making admissibility determinations).

172. For discussion of admissibility problems with respect to novel sciences under *Daubert* inquiry, see *supra* notes 87-129 and accompanying text. For discussion concerning arguments against dispositive application of *Daubert* factors, see *supra* notes 139-167 and accompanying text.

173. See Gussak lecture, *supra* note 62 (discussing growing awareness in legal community with respect to admissibility of novel sciences as causation evidence); see also Miller & Rein, *supra* note 7. Miller & Rein note that:

The pro-plaintiff group, Trial lawyers for Public Justice, recently expressed to the Supreme court that “a number of trial judges . . . have assumed the roles of jurors and ‘amateur scientists’ in rejecting expert testimony with which they disagree, effectively barring the victims of mass torts and toxic exposures from the courthouse.” This is perhaps one of the clearest indications of the growing tendency in trial courts to undertake a rigorous review of proposed causality testimony breaking new, non-peer-reviewed, and generally-disputed ground.

Id. at 572-73. But see *Becker v. National Health Products, Inc.*, 896 F. Supp. 100, 104 (N.D.N.Y. 1995) (admitting expert testimony based upon relatively novel sciences).

174. For discussion of “junk science,” see *supra* note 43 and accompanying text.

175. See Miller & Rein, *supra* note 7 at n.94 (discussing courts’ unwillingness to adopt a new doctrine).

reached her conclusion.”¹⁷⁶ Another possible remedy to plaintiff’s causation problem, as previously discussed, requires plaintiff to argue that the Federal Rules and *Daubert* intend a less-restrictive and flexible application of the admission criteria.¹⁷⁷ Counsel should promote the role of the jury in the adversary system and urge the court to understand the difficulties associated with demonstrating the reliability and usefulness of novel sciences.¹⁷⁸

One more possibility exists, however, that may allow courts to distinguish between “junk science” and novel, but admissible, science and at the same time allow plaintiffs to have an opportunity to establish causation. *Kuhmo Tire* and Federal Rule of Evidence 706 provide guidance in this regard.¹⁷⁹ When deciding preliminary questions of admissibility, courts may employ their own experts.¹⁸⁰ Court-appointed experts may be useful to help judges, who ordinarily have little or no scientific background, to distinguish between “junk science” and science that is not, under *Daubert*, “grounded in science,” “peer reviewed” or “generally accepted” because it is novel.¹⁸¹ The court-appointed expert, as a neutral, third party, may be “needed to investigate reliability.”¹⁸²

Toxic tort cases provide a perfect opportunity for district court judges to employ experts for this use.¹⁸³ Nearly a century ago, Judge Learned Hand proposed a similar resolution to the admissi-

176. James E. Morgan, ed., 24 LITIG. NEWS No.3, 12 (Mar. 1999) (citing James R. Ronca).

177. For discussion of flexible, more “plaintiff-friendly” interpretation of *Daubert*, see *supra* notes 139-67 and accompanying text.

178. For discussion of arguments favoring the adversary system and the role of the jury over the judge’s exclusionary power with respect to expert evidence, see *supra* notes 160-62 and accompanying text. For discussion of difficulties associated with expert causation evidence grounded in novel sciences, see *supra* notes 87-129 and accompanying text.

179. See *Kumho Tire*, 522 U.S. at 141 (discussing ability of trial judges to engage in special briefings or proceedings in order to investigate reliability of proffered evidence); see also FED. R. EVID. 706 (granting judges authority to appoint their own expert witnesses).

180. For discussion of court-appointed experts, see *supra* note 177 and accompanying text, and see *infra* notes 179-85 and accompanying text.

181. See Judith A. Hasko, Note: *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Flexible Judicial Screening of Scientific Evidence Under Federal Rule of Evidence 702*, 1995 Wis. L. REV. 479, 501-04 (discussing judges’ need to familiarize themselves with scientific principles in order to decide preliminary questions on admissibility of experts).

182. See *Kuhmo Tire*, 522 U.S. at 141 (noting that courts may use experts or other proceedings in order to investigate reliability of evidence).

183. See Hasko, *supra* note 181, at 501-04 (discussing that court-appointed experts would be helpful to judges making admissibility determinations).

bility problem.¹⁸⁴ He concluded that conflicting expert testimony should be presented to a “board of experts or a single expert, not called by either side” who would relate a final statement to the jury.¹⁸⁵ In order to preserve the jury’s fact-finding role, Judge Hand maintained that the testimony proffered by the non-biased panel or single expert should have evidentiary, rather than conclusive, status.¹⁸⁶ It is obvious that the admissibility determinations inevitably remain with the trial judge acting as the “gate keeper.”¹⁸⁷ Whether the trial judge will consider arguments that favor admissibility and whether the judge will employ his own experts in order to help make reliability determinations is solely within the judge’s discretion.¹⁸⁸ Maybe the question is not, “Which way do *we* go, Judge,” but rather, “Which way do *you* go, Judge.”

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184. See Miller & Rein, *supra* note 7, at 576 (quoting Learned Hand, *Historical and Practical Considerations Regarding Expert Testimony*, 15 HARV. L. REV. 40, 56 (1901)).

185. See *id.* (discussing Learned Hand’s suggestion for addressing admissibility issues).

186. See *id.* (citing Hand, *supra* note 184, at 56-57).

187. For discussion of judge’s role as “gate keeper,” see *supra* note 63.

188. For discussion of discretion with respect to preliminary questions of admissibility afforded to district court judges, see *supra* notes 61, 76-77, 79-82, 132, 134-38, 166, 185 and accompanying text.

